

## CHAPTER 42

### GUIDELINES FOR THE DESIGN OF GROUND MOUNTED SIGN SUPPORTS

#### 42.1 Introduction

The designer will select the sign structures from the tables herein when the standard DDOT sign structures cannot be used on the project. Highway signs fall into two main categories and are subdivided as follows:

##### 42.1.1 Overhead Signs

- Sign Bridge Structures
- Sign Cantilever Structures
- Bridge Mounted

##### 42.1.2 Ground Mounted Signs

- Small Highway Signs
- Large Highway Signs

This section covers the design guidelines for Ground Mounted Sign Supports. These guidelines have been developed utilizing the current **AASHTO A Policy on Geometric Design of Highways and Streets**, the **AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals**, the **AASHTO Roadside Design Guide**, and the **Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)**. The designer has four options from which to choose when locating signs within the highway Right-of-Way (ROW). These options are:

- Locate the sign beyond the clear zone. The clear zone should be in accordance with the AASHTO Roadside Design Guide and based on the posted speed limit.
- Mount the sign overhead.
- Utilize a breakaway support to reduce impact severity.
- Shield the sign with a longitudinal barrier and/or crash cushion.

Ground mounted signs should desirably be located beyond the clear zone. In addition, all ground mounted highway signs are to be installed on breakaway supports, unless otherwise indicated herein. When a sign is located behind a traffic barrier (which is required for another reason), non-breakaway supports

may be used. In cases where noise walls are required at a particular sign location, additional berm widths may be necessary.

In considering the above, it is critical that sign locations and the design of the sign support be considered early in the Initial Design Development Stage. In addition, where sign supports must be shielded, the design engineer must determine the minimum area to be provided to accommodate guiderail or a state-of-the-art crash cushion.

## **42.2 Small Highway Signs**

Small highway signs are defined as those with total panel areas less than 50 square ft. When this category of sign is used, the design guidelines for its support shall be steel “U” post sign supports (2 posts if the sign area is over 50 sq. ft.). The District’s standard sign post (“U” post) is twelve (12’) ft. in length and weighs 3.0 lbs./ft. (before punching and galvanizing). Aluminum posts are not permitted for small highway signs. Small highway signs shall not be placed in front of guide rails, and the posts shall not straddle guide rail. All small highway sign supports shall be of the breakaway type with the exception of those installed behind guiderail or behind other roadside barriers.

The contractor shall be responsible for determining the horizontal offset with the concurrence of the TSA Project Engineer, the quantity of posts, the post size and their associated lengths. The designer shall be responsible for establishing all offsets, quantity of posts, post sizes and lengths by following the step-by-step design guidelines below.

### **42.2.1 Step 1**

Once provided with the necessary panel size, determine the horizontal offset ( $X_1$ ) from edge of pavement to inside edge of sign, as shown in Table 42-A within this chapter, by applying **Section 2A-24 of the MUTCD** as follows:

- Urban installations – 1 ft. minimum from curb face where sidewalk width is limited or existing poles are close to the curb.
- Interstate and Freeway installations – 6 ft. minimum from edge of shoulder, but not less than 10 ft. from the edge of traffic or auxiliary lane.

### **42.2.2 Step 2**

When determining the height of ground-mounted signs, the following checks should be made:

- When signs are installed on slopes 10H:1V or flatter the minimum vertical clearance above the edge of pavement to bottom of the sign panel as shown in Table 42-A are as follows:
  - Sign Panels:
    - For single post installations, if possible, the minimum distance above the edge of pavement to the bottom of any panel must be 7 ft. in accordance with the MUTCD.
  - The District frequently places several sign panels on a single sign post. In addition, when several sign panels are placed on a single post, the sign panels may drop below the 7 ft. level.
  - For multi-post installations, the minimum distance above the edge of pavement to the bottom of a main sign panel must be 7 ft.
  - Secondary Sign Panels:
    - The minimum distance above the edge of pavement to the bottom of a secondary sign panel (or a third sign panel) is 6 ft. When the height of the panels fall below the minimum 7' level, engineering judgment should be exercised to avoid placing these signs in or near pedestrian crossing areas.
    - For interstate and freeways the bottom of the main sign shall be a minimum of 8 ft. and secondary sign panel a minimum of 5 ft. above the edge of pavement.
- Where grading of 10H:1V or flatter cannot be obtained or where there is curb or berm greater than 4 in., the minimum vertical clearances will be measured from the ground line to the bottom of the sign.

### 42.2.3 Step 3

Determine the maximum distance (L) from the ground line to the centroid of the sign panel in ft. and determine the sign panel area (A) in square ft.

NOTE: Sign Supports shall not be placed on slopes steeper than 10H:1V except where grading of 10H:1V cannot be obtained or where they will be behind a traffic barrier.

### 42.2.4 Step 4

Determine the size and quantity of posts per sign from Table 42-B for "A" up to 50 S.F. and "L" from 7 ft. - 15 ft.

NOTE: When the plotted values of "A" and "L" on Table 42-B indicate an undefined section of the chart, then an alternate design for large highway signs must be initiated.

NOTE: When there is an option of using either a 2.5 lbs./ft. post or a 4.0 lbs./ft. post, the following applies:

- The maximum sign width (W) for single post installations shall be 2.5 ft.
- If the number of posts selected are the same, the 2.5 lbs./ft. post should be used.
- When the number of 2.5 lbs./ft. posts selected are greater than the number of 4 lbs./ft. posts, the 4 lbs./ft. posts should be used.

Example:    A = 20 S.F.  
                  L = 10 ft.  
                  Roadside Slope = 10H:1V

From Table 42-B, the number of posts that may be selected are:

- Three – 2.5 lbs./ft. posts or
- Two – 4.0 lbs./ft. posts  
- Therefore, use two – 4.0 lbs./ft. posts.

#### 42.2.5 Step 5

After completing Steps 1 through 4 for each sign, determine the post length(s) (P) and enter all the data onto the Steel "U" Post Sign Support Data Table for that project. The following is an example of a post selection for a non-standard sign:

Highway Type - Freeway  
Sign No. GA - 4  
Size: 10 ft. by 4 ft.  
Roadside Slope < 10H:1V

From the information provided:

Area (A) = 40 S.F.  
Horizontal offset ( $X_1$ ) = 6 ft. (min.)  
Vertical clearance = 7 ft. (min.)  
Ground line to centroid (L) = 9 ft.

From Table 42-B:

Use three – 4 lbs./ft. posts.

Distance between posts =  $W/3 = 40$  in. refer to Table 41-A)

Post Length (P) =  $7 + 4 = 11$  ft.

Finally, enter the data onto the Steel “U” Post Sign Support Data Table.

## 42.3 Large Highway Signs

Large highway signs are defined as those with a panel area equal to or greater than 50 square ft. When this category of sign is used, the design guidelines for the support shall be “Non-Breakaway Sign Supports”. Non-breakaway sign supports shall be installed behind roadside barriers used to shield other roadside obstructions. When a non-breakaway sign support is placed behind guide rail, the support should be a minimum of 4 ft. from the back of rail to the face of the signpost. When a non-breakaway sign support is placed behind barrier curb, the support shall be a minimum of 1.5 ft. from the back of barrier curb to the face of the signpost.

### 42.3.1 Non-Breakaway Sign Supports

The following is a step-by-step guide to the design of non-breakaway sign supports.

#### 42.3.1.1 Step 1

Once provided with the size of the main panel, determine the horizontal offset,  $X_1$ , from the edge of pavement to the edge of panel. Recommended offset = 8 ft., minimum offset = 7 ft.

#### 42.3.1.2 Step 2

Determine the elevation from the edge of pavement to the bottom of the main panel. Minimum elevation = 7 ft. (refer to Figure 42-F). For fill sections, go to Step 3. For cut sections, hold the berm side bottom of the main panel at a 1.33 ft. minimum above ground line.

#### 42.3.1.3 Step 3

Determine the number of posts required for the specified panel based on a maximum sign area per post of 192 ft.<sup>2</sup> (refer to Figure 42-F).

Example:  $A_1 = 30$  ft.      AREA = 450 ft.<sup>2</sup>      H = 15 ft.

The calculated sign area suggests a minimum of three posts. The required spacing between posts for a three-post system is  $A_1/3$ . This translates to a 10 ft. spacing between posts (refer to Figure 42-F).

#### 42.3.1.4 Step 4

Determine the distances from the top of footings to bottom of the main panel,  $L$ , for each post.

NOTE: The minimum height of any post from ground line to the bottom of the main panel shall be 2.5 ft.

#### 42.3.1.5 Step 5

Determine the required values of  $L_{\max}$ ,  $H$ , and  $A_1$  where:

$L_{\max}$  = Maximum post length to bottom of main panel (ft.)  
 $H$  = Main panel height + Exit panel height (ft.)  
 $A_1$  = Main panel width (ft.)

#### 42.3.1.6 Step 6

Determine moment of sign area per post, MSA:

$P$  = Number of sign posts  
 $MSA = [A_1 * H * (L_{\max} + (H/2))] / P$

#### 42.3.1.7 Step 7

Using the value obtained in Step 6, determine the post diameter, wall thickness, and base type from Table 42-D below. Use this selection for all posts in the structure.

Table 42-D:  
Post and Base Selection Table

POST DIMENSIONS			
MSA (ft. <sup>3</sup> )	Outside Diameter (in.)	Wall Thickness (in.)	Base Type
420	6	1/4	A
800	8	1/4	A
1300	10	1/4	B
1920	12	1/4	B
2510	12	3/8	B

**42.3.1.8 Step 8**

Determine  $C_1$ ,  $D_1$ , and  $E_1$  for each post.

**42.3.1.9 Step 9**

Determine  $F_1$ ,  $G_1$ , and  $H_1$  for each post. Values above reference line are positive; values below reference line are negative.

**42.3.1.10 Step 10**

Enter all the data onto the Non-Breakaway Sign Support Data Table.

## **42.3.2 Nonvegetative Surface Under Overhead Signs and Large Ground Mounted Signs**

In order to reduce soil erosion and highway maintenance costs associated with spraying or trimming vegetation underneath signs, non-vegetative surfaces should be applied around the foundation of overhead signs and underneath large ground mounted signs as follows in Table 42-E:

Table 42-E:

SIGN TYPES	CONDITIONS WARRANTING USE OF NON-VEGETATIVE SERVICES
Overhead signs	
Sign bridge	All cases
Sign cantilevers	All cases
Large Ground mounted signs	
Breakaway sign supports	Mowable areas
Non-breakaway sign supports	Mowable areas

NOTE: This surface treatment is not to be used at breakaway steel “U” post sign support locations.